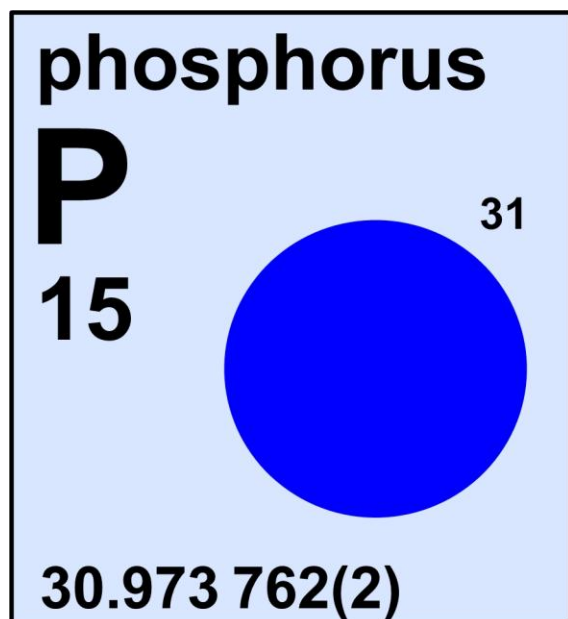
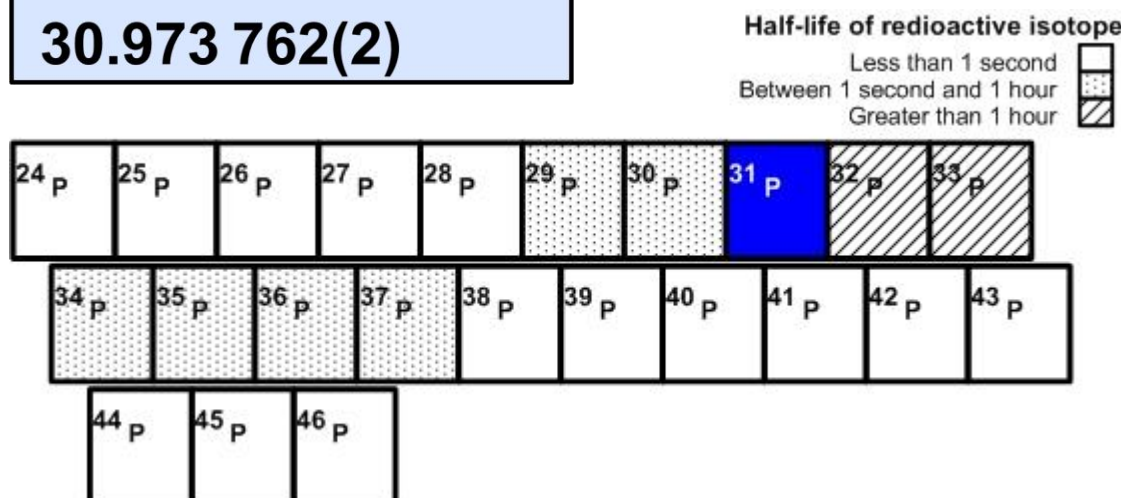


phosphorus



Stable isotope	Atomic mass*	Mole fraction
^{31}P	30.973 761 63	1.0000

* Atomic mass given in unified atomic mass units, u.



Important applications of stable and/or radioactive isotopes

Isotopes in medicine

- 1) ^{32}P Phosphorus can be used as a therapeutic radiopharmaceutical. By injecting a patient with ^{32}P , as an orthophosphate or polyphosphate, osteoblastic-reactive bone, tumors, and other cells are targeted and the beta-emission from the radioactive isotope can lead to cancerous-cell killing, as well as pain reduction. For example, Polycythemia vera is the condition of having excess red blood cells in the bone marrow and ^{32}P can be used to treat this condition by reducing the number of red blood cells, however, there is no cure for this condition.
- 2) ^{32}P has also been used as the radioactive target in brachytherapy of solid tumors using a ^{32}P labeled Bio-silicone product. Tested on humans with inoperable intra-abdominal hepatocellular carcinoma, the ^{32}P offered a localized radiation (beta emission) to tumors and has shown some success in tumor reduction.

Isotopes in tracer studies

- 1) ^{32}P is a radioactive isotope of phosphorus used to help comprehend the biological and chemical processes that occur in plants. It is chemically identical to other isotopes of phosphorus and can be substituted in biological and chemical reactions. For example, a phosphate solution containing ^{32}P , which has the identical behavior of non-radioactive ^{31}P , can be inserted into the roots of a plant and then its movement tracked throughout the plant with use of a Geiger counter. This movement detection study helps scientists to better understand how the plant uses phosphorus in order to reproduce and grow.
- 2) On more of a molecular level, ^{32}P can substitute ^{31}P in nucleotides of DNA or RNA. Radioactive probes can be created to help identify the presence, absence and quantity of genes in a system.
- 3) ^{32}P isotopes can be used to detect tumor locations within the body. The isotope, ^{32}P is a radioactive isotope that emits beta particles. When this isotope is attached to antibodies specific to cancerous tumors, it can be imaged in vivo by scintigraphy. This is useful for imaging cancer sites and for treatment monitoring of oncologic patients.
- 4) Depending on the type of ^{32}P labeled compound, when ingested or injected in the body, specific body parts (blood, tumors, joints, or bones), can be targeted for visualization and imaged using a scintillation camera.
- 5) ^{32}P has been added to tires by Goodrich labs to help determine the location and depth of tire wear in performance tests.
- 6) ^{32}P has been used as a tracer to help determine phosphorus nutrient cycling in eutrophied lakes. In one experiment phosphoric acid labeled with ^{32}P was added to a lake that had been experimentally eutrophied. ^{32}P was measured in microphytoplankton, phytoplankton and zooplankton and the amount of incorporated ^{32}P determined.
- 7) ^{32}P and ^{33}P have been used to better understand phosphorus dynamics in the environment at the sediment surface level. Phosphorus is a necessary nutrient for many biota and knowing the bioavailability and sorption of this nutrient to particles in soil is very important to helping us understand the health of our ecosystems. By labeling organic and inorganic phosphorus substrates (anions) in a sediment system, these radioactive elements can be extracted and measured.

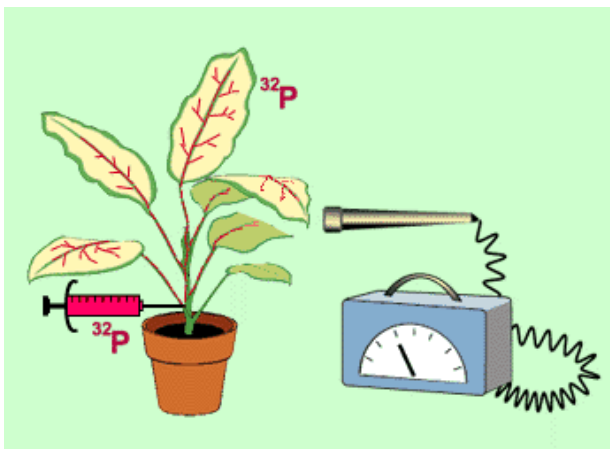


Figure 1: ^{32}P addition to plants and detection using a Geiger counter.